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Nitrogen dynamics in low input Northern and Southern European cropping systems with grain legumes

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Grain legumes have been inserted in cereal cropping systems for nitrogen economy and diversification purposes (1). In spite of the high N in soil after pea, there remains a great variability in N available for next crop, mainly due to variability in inorganic residual N at GL harvest which is related to the 2 following ratios: N fixation/N assimilation and N grain/N vegetative (2). Moreover, because of high N and water in soil at harvest, high N leaching is expected after pea during following rainy winter (3). After pea, only crops with efficient N taking-up in the autumn/winter should be grown to prevent N losses (e.g. oilseed rape, catch crop, intercrop) (3, 4). In order to better understand the effect of GL on N dynamics and to evaluate this nitrate leaching risk lysimeter and field experiments were carried out in low input cropping systems at RISØ institute (Denmark) and at INRA (SW France) during three years within the framework of the GLIP project. The final objective was to investigate the best means to mitigate this N loss from GL cropping and then to optimize the N valorisation coming from N_2 fixation for the succeeding crop and maintain soil fertility.

The results obtained during the three years experiments as well in France as in Denmark confirmed that i) GL is an efficient preceding crop for cereals as N uptake is significantly greater after pea or fababean than after non leguminous crops, and ii) nitrate leaching could be higher after GL in rainy conditions of winter. As a confirmation of results obtained few years ago in incubation studies, the incorporation of GL residues induced more net N immobilization than net N mineralization during the following months after soil tillage. Finally, cover crops were found efficient to decrease N amount in soil during autumn and then the risk of nitrate concentration in drained water.

Simulations were done using the STICS soil-crop model at the succession scale in order to better understand N dynamics in such a system. Various pedoclimatic scenarios of GL-cereal successions will be compared soon in terms of nitrate leaching in order to generalize there experimental results and to draw some operational conclusions in terms of N management at the cropping system scale including GL.

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